Chautauqua Access Management Plan

Transit Analysis

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For the City of Boulder

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Introduction

The Colorado Chautauqua National Historic Landmark and nearby open spaces are signature places in Boulder, popular among locals and visitors as destinations for outdoor recreation and concerts.

Located in the southwest area of the city, the term "Chautauqua" is used here to refer to the area in the vicinity of the Chautauqua leasehold neighborhood near 9th St and Baseline Rd, including the various open space entrances, the CCA Cottages residential area, and Chautauqua Auditorium.

In recent years, travel to these destinations has increased, leading to a concern on the part of Chautauqua-area neighbors about impacts to the local parking supply, as visitors to the open space and Chautauqua facilities park cars and walk down adjacent neighborhood streets.

The nature of this demand is highly seasonal, and is focused on the summer months when outdoor activities in the area are most attractive, and when the bulk of the Colorado Chautauqua's artistic programming occurs.

In 2015, after the renegotiation of lease between the City of Boulder and the Colorado Chautauqua Association, the two parties to the lease began a cooperative process to devise an access management strategy to address these challenges.

The Chautauqua Access Management Plan (CAMP) seeks to maintain (or even enhance) public access to the Chautauqua amenities by providing alternative modes and other strategies to reduce single-occupant vehicle access, in order to reduce vehicular impacts in the area and carbon consumption. The overall planning process incorporates input from the Community Working Group, with assistance by the local planners and engineers of Fox Tuttle Hernandez (FTH).

The City of Boulder has committed to piloting a set of strategies focused on maintaining and enhancing access to Chautauqua, in the summer of 2017. Based on the results of those pilot strategies, longer-term strategies may be developed.

1 Identifying Needs

This memo is focused on exploring the possible role that public transit could play in maintaining or enhancing public access to the Chautauqua amenities.

The first step in addressing a local planning issue is to develop an understanding of its scope and magnitude, and to define criteria that can be used to design a successful method of addressing it.

FTH has done a thorough analysis of visitor traffic to Chautauqua area[1], the key pieces of which we reproduce throughout this chapter.

1. Study materials are available at: bouldercolorado.gov/pages/chautauqua-access-management-plan

Study area

Figure 1 shows a detailed map of Chautauqua area, labeling the key destinations and access features. These include:

- Chautauqua open space, the large regional green space whose main entrances are in this area. While various small trails lead into the open space along baseline, the main entry point is off Kinnikinic Rd at

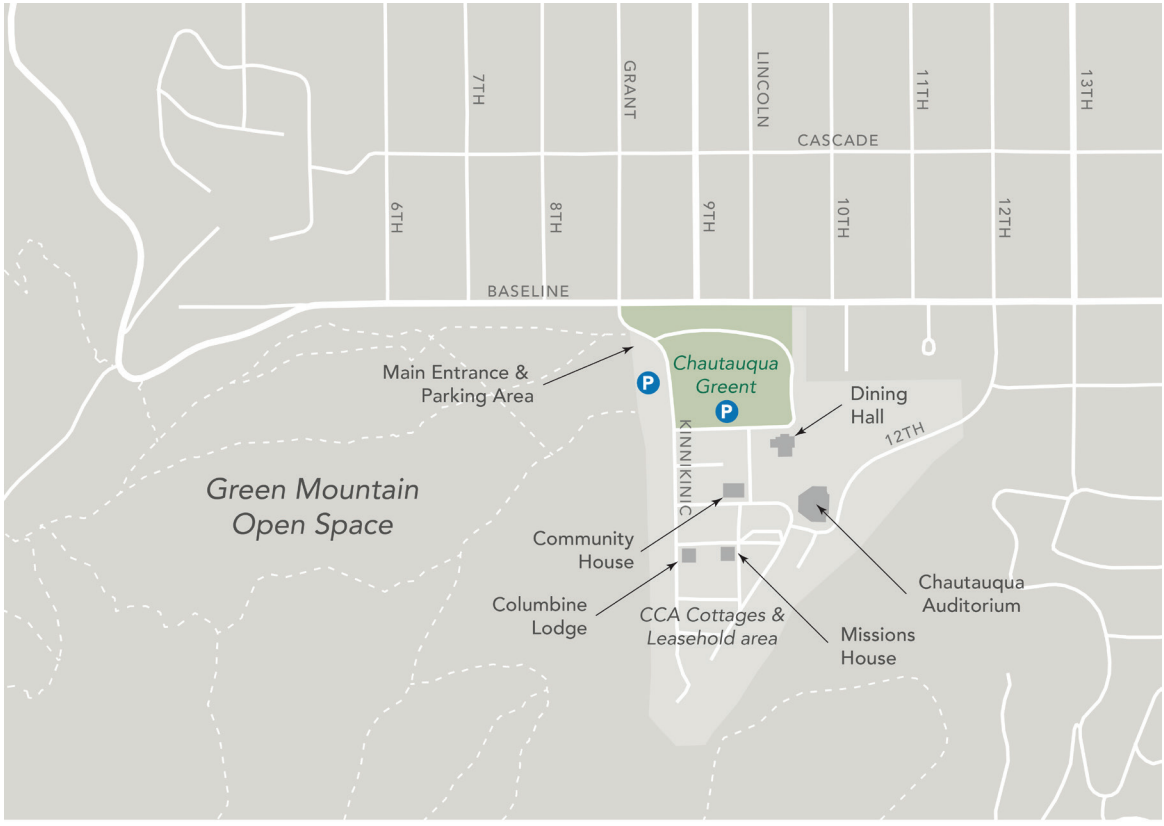


Figure 1: Map of Chautauqua area.

the north end of the neighborhood, near the Ranger Cottage and adjacent parking area. This is the primary destination during the periods of peak demand in the summer.

- Chautauqua Auditorium, the facility used by the Colorado Chautauqua to provide a wide variety of art and music programming. It has a capacity of about 1,300 people.
- Chautauqua Community House, a smaller 125-person capacity event venue near the Auditorium.
- Visitor lodgings at Columbine Lodge, Missions House, and in cottages throughout the leasehold neighborhood.

Key access features include:

- The Ranger Lot, the main off-street parking lot in the area, located east of Kinnikinic and Chautauqua Green near Baseline Rd.
- Chautauqua Green has angled parking on two sides.
- Free on-street parking is available along Baseline, on north-south streets, and on a limited basis within the CCA Cottages residential area.
- Baseline Rd & 9th St are two-lane roads carrying the heaviest traffic loads through this area.

Parking study findings

FTH conducted a variety of transportation studies in the area in summer 2016, including examination of visitor origins, traffic volume and parking utilization.

Chautauqua visitors

Using Acyclica data and an intercept survey, FTH has analyzed the travel behavior of people using the Chautauqua area.

An intercept survey conducted by NRC found that 62% of visitors to the area came from outside of Boulder, and that approximately 85% of local, regional, and out of state visitors drive to Chautauqua. Approximately 70 to 90% of Boulder residents who took the survey also indicated they drive to Chautauqua.

FTH Parking Utilization Study

Figure 2 shows the blocks surveyed by FTH during the parking study. This study examined the number of cars parked along either face of each block. One way to measure parking use in Chautauqua area is the proportion of time during the summer that parking on neighborhood streets is nearly or completely used up.

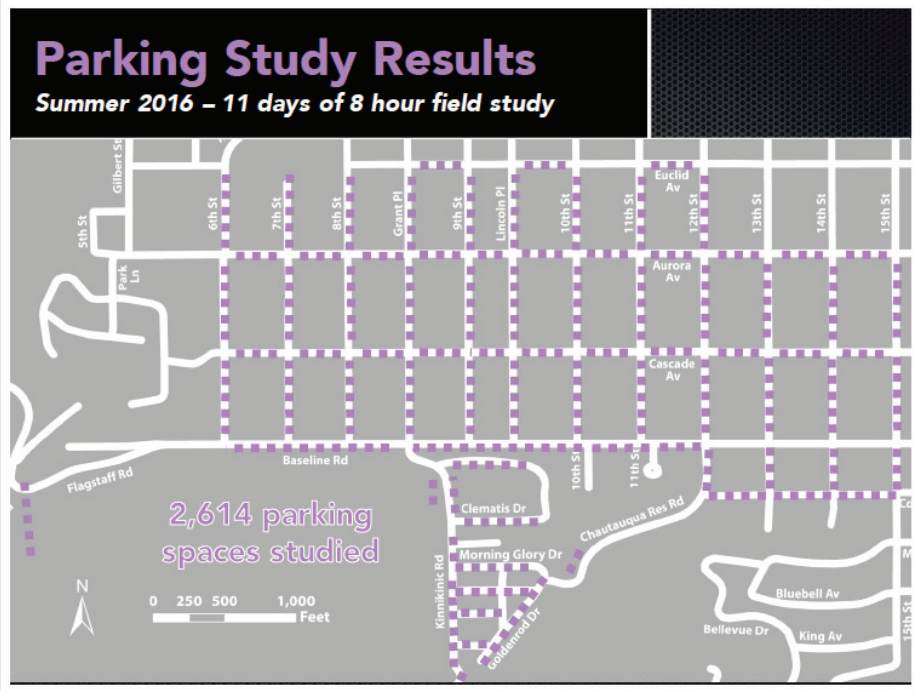


Figure 2: FTH Parking Study area

Different methods could be used to define thresholds of parking utilization at which action could be taken. Management strategies could then be designed to reduce the proportion of blocks in the study area where parking utilization exceeds that threshold.

Summer 2016 Conditions

The maps at right show the blocks on which more than 75% of parking spaces were used (at top) or between 50% and 75% of parking spaces were used (at bottom). All blocks not highlighted in one of these two maps had parking utilization rates of less than 50%.

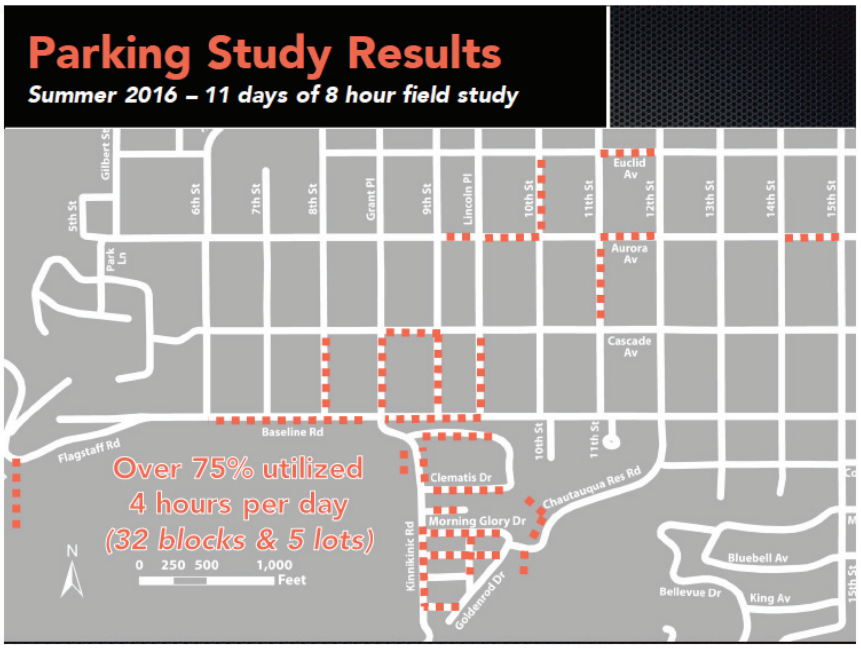


Figure 3: Parking Study : 75%+ utilization

75%+ utilization rates were widespread in the leasehold area, along Baseline near the open space entrances, and along the blocks immediately north of Baseline. A few block faces further north also registered high utilization rates, though the greatest number are localized to the access points to Chautauqua. Many other blocks in this vicinity have utilization rates between 50% and 74%.

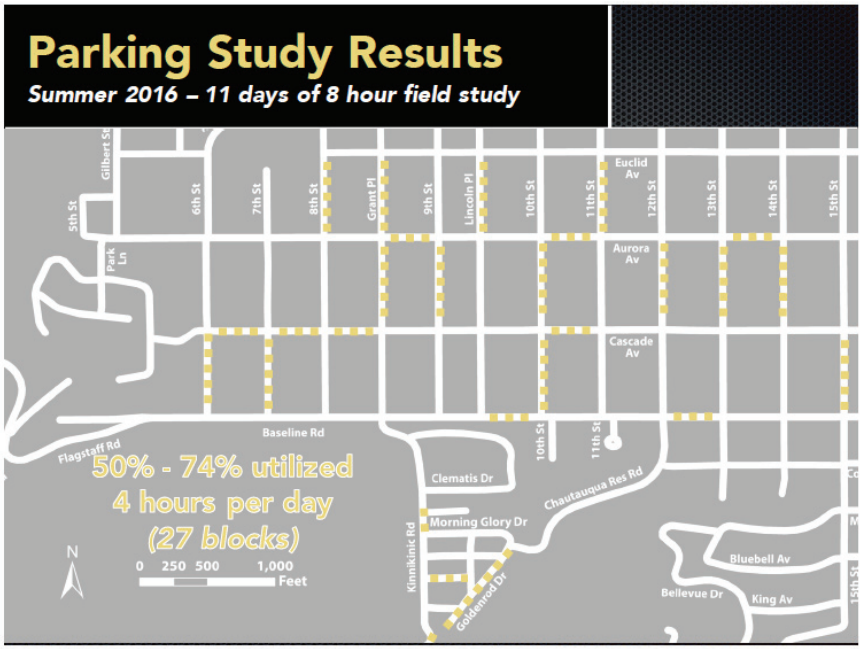


Figure 4: Parking Study : 50-75% utilization

How does parking utilization relate to the access goals for Chautauqua?

We can make observations about where the parking supply is most in demand. Whether or not action should be taken based upon these observations is a question that ultimately rests with the community, to be made based upon the degree to which those utilization rates reflect a negative impact to the public's ability to access the area.

In a busy neighborhood commercial corridor, 75-80% parking utilization is often considered to be a sign that

supply and demand for parking are largely in balance, because it means that visitors to local businesses can nearly always find a parking spot on that block.

However, in residential neighborhoods of single-family houses, people have different expectations. The ability to nearly always find a parking spot *on one's block* may be no reassurance, if one can't regularly find a parking spot *in front of one's house.*

The highest utilization rates were found in the parking areas immediately around Chautauqua Green, the Auditorium, along Baseline near the main entrances to the open space, and on the single blocks to the north of Baseline. High average parking utilization was observed throughout the leasehold area and along the blocks of 8th, Grant Pl, 9th, and Lincoln Pl, as well as on Baseline adjacent to the open space entry points.

When people are often parking in ordinarily-quiet residential neighborhoods for special events, parking utilization is only one impact. Other impacts include noise, which is generated by people walking to and from their cars, and also by people talking loudly or playing music in and around their cars, as well as trash.

The goal statement of this process is "to maintain (or even enhance) public access to the Chautauqua amenities by providing alternative modes and other strategies to reduce SOV access in order to reduce vehicular impacts in the area and carbon consumption". Parking utilization rates are an important indicator for the performance of different strategies towards these outcomes.

Future planning work in this process will consider how different approaches to providing public transit service could combine with access management strategies to improve public access and reduce vehicle impacts. Utilization rates will be an important bellwether for the impact of these strategies.

2 Addressing Impacts

If the goal of the Chautauqua pilot project is to enhance public access while also reducing vehicle impacts, the strategies used to do so must offer both disincentives to driving and viable alternatives for visitors to continue to access the area.

Transit can be an effective way method of addressing parking issues of this sort, but we advise the City and the community that transit service alone will be insufficient to reduce driving and parking demands to any significant degree. Rather, transit can be the "carrot" offered to visitors, to make the application of some kind of "stick" more reasonable and effective.

Before thinking about what type of transit service would best support a parking demand management program focused on these goals, we must also consider the general suitability of the Chautauqua area as a transit market. This has bearing on whether an all-year transit service could attract high ridership, even during months when parking demand is lower, or whether a more targeted, seasonal or event service is appropriate.

In this section, we review best practices for designing high ridership transit services, examine the transit service that operated in this area in the past, and describe several possible ways that transit could support access management at and near Chautauqua.

How can transit be used effectively?

For this project, it may be important for any transit service complement to an access management program to actually be ridden. On the other hand, one could make an argument that the mere presence of a transit service is enough, if it is used as a complementary strategy with managed parking. Which of these statements rings true will inform what the goal of a Chautauqua transit service is: simple availability and presence, or actual ridership. Neither answer is correct, but the answer will shape the eventual recommended strategy.

If it is desirable that the transit element of such an access plan is well-used (such that limiting parking availability doesn't reduce the overall accessibility of the site), then it must attract high ridership. A transit service gets high

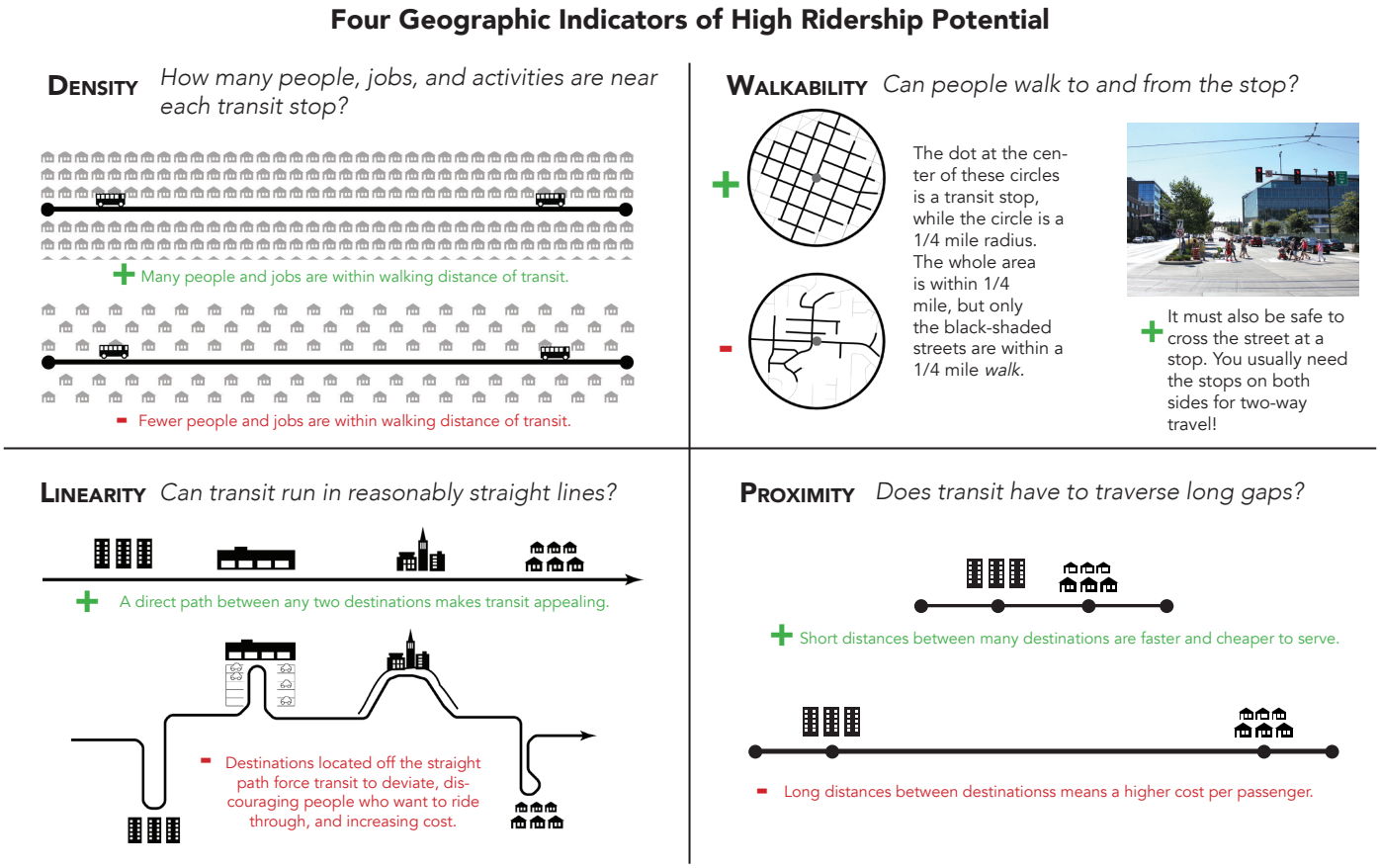


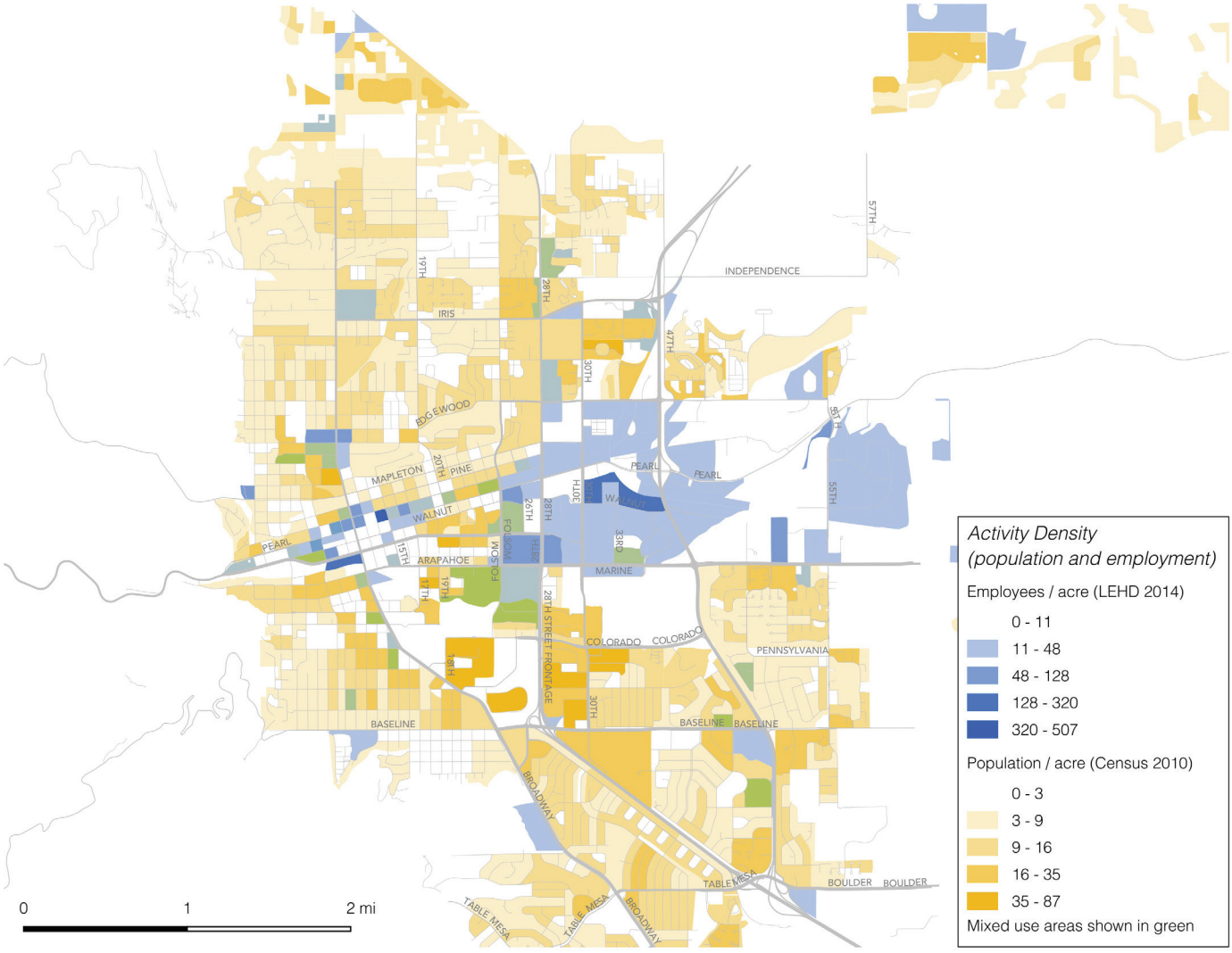
Figure 5: The Ridership Recipe

ridership when a large number of people find it *workable*, even if it is not *ideal*.

A major factor in whether someone finds transit workable is *when* it is available. This depends on its frequency (how long the wait is between buses) and its span (the hours and days of the week when it is available).

In addition to the frequency and span of the service, certain aspects of the built environment have a big impact on whether a transit service can attract high ridership. They are illustrated above, in the "Ridership Recipe." Together, these factors help determine how competitive transit's travel time and convenience is, compared to driving. Parking management provides an additional incentive to take transit, since most management strategies increase the cost (in time, money or hassle) of using a private car to reach the destination in question.

The map on the next page shows the distribution of population and employment density in Boulder one of the important factors for ridership mentioned above.



Activity density

In this map, population density is shown in yellow, and employment density is shown in blue[2]. Places where these uses are mixed are shown where the colors mix to form green.

In Boulder the highest ridership routes, like the Skip, Bound, Dash and Hop, traverse areas of mid and high density of both residential and commercial uses.

Southwest Boulder, by contrast, is a lower-density, mostly single land-use area. Apart from the open space and Chautauqua lodging and entertainment venues themselves, there is little other activity in the area that is not already served by frequent transit. According to the Colorado Chautauqua Association, approximately 165 people are employed between the CCA, the Colorado Music Festival, and dining and lodging operations

Figure 6: Residential and job density data, combined onto one map.

Note that CU students are not represented in employment data, otherwise CU would show up as darkly shaded on this map.

2. More detail on population and employment density is available in the appendix at the end of this report.

during the summer season, and about half that number during the non-peak season. This suggests that if the transit component of a Chautauqua access management program ran all year long, it would not generate high ridership relative to its cost, and that a solution more focused on the periods of high-demand may be more efficient.

Current and past Chautauqua transit services

Currently, Chautauqua is not directly served by regular transit service. A number of routes on Broadway offer frequent service about one mile to the east, while the City's frequent HOP route reaches 9th and College, about 0.5 miles away. The City is studying alternative ways to use the service resources currently devoted to the HOP, several of which involve reducing the frequency on the segment of the route east of Broadway, as well as detaching that segment as an independent route.

Transit that has been provided to Chautauqua in the past can give us a sense of the area's ridership potential, under different transit service scenarios.

The first was RTD's route 210, a local transit route connecting downtown Boulder and CU, which was discontinued due to low ridership. RTD also had a second route, the 203, which served Baseline and Chautauqua until 2012. The last example is the City of Boulder's Hop2Chautauqua concert shuttle.

RTD Route 210

RTD's 210 was a short route connecting downtown, Chautauqua, and CU, mainly using Arapahoe, 9th and Baseline. It ran half-hourly, operating weekdays only. By 2005, when the route was discontinued, it was seeing an average of around 50 boardings per day.

While RTD was unable to provide specific cost information, our estimate based on the run times and scheduled departures yields a route-level productivity of around 3 to 4 boardings per revenue hour. That means that for every hour a bus was in service on the route, 3 to 4

Figure 8: Existing transit services in southwest Boulder

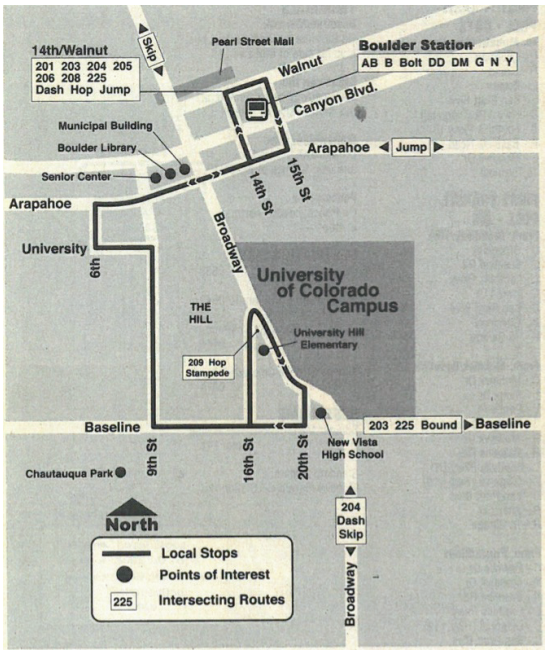


Figure 7: RTD Route 210, circa 2005

people got on. By contrast, RTD's current Boulder routes operate at productivities of between 16 and 44 boardings per revenue hour. (Boardings per revenue hour is a good measure of "efficiency" in transit, because so much of transit's cost is labor, which is tied to hours of service.)

On the surface, the case of the 210 seems like a warning against expecting much ridership from an all-week all-year transit service to Chautauqua. After all, if it didn't work the first time, could it today attract enough people to use it to make a dent in the parking issue? By examining some of the reasons why this prior attempt to provide transit service may have failed to generate much ridership, what can we learn about a future attempt?

Some facts suggest that transit demand in the area might be higher today than in the past:

- New Vista High School at 20th and Baseline was a middle school at the time.
- Chautauqua and the surrounding open space were not receiving the volume of visitor trips they are today, especially not for special events and outdoor recreation.

On the other hand, transit demand might be lower because:

- Driving used to be more expensive than it is today (though that could change in the future, due to national or local dynamics).
- Regional and local transit services along Broadway are more frequent today than they used to be, which means that they will compete against any parallel route (such as the HOP or the 210) more than they used to.
- Cycling is easier and more comfortable than it used to be, due to substantial investments in the cycling network and infrastructure made by the City of Boulder over the past decade.

Route 210 had low ridership because it was not useful for very many people. The average wait (either at departure or arrival) would be 15 minutes (one half of the 30-minute frequency). Once on the bus, the ride from one end to the other would have taken about 15 minutes. That means that the average travel time between downtown and Chautauqua would have been

around 25-30 minutes. Google Maps estimates a walk time from Chautauqua to Downtown 30 minutes, without the uncertainty or inconvenience of the transit schedule (though obviously the comfort, time and convenience of walking is highly varied based upon the circumstances of the person in question). For many people making shorter trips within the neighborhood, or between the northern part of the neighborhood and Downtown, walking would have been a faster option requiring no waiting.

Finally, for most people on University Hill or the area between Broadway and 9th, service at low frequencies on 9th would have been redundant to the collection of routes operating more frequently on Broadway. Broadway also offered connections to a wider range of possible destinations. With the introduction of more frequent routes and regional Flatiron Flyer service in the period since, this issue for the southwest Boulder transit market is even more apparent today. Most trips to and from the neighborhood are faster using service on Broadway than service on 9th, because of the high frequencies and long distances offered on Broadway.

Because of the concentration of services on Broadway, as well as the frequent HOP on 9th and College, a Chautauqua route's unique market is limited to the area roughly bounded by Euclid in the north and Baseline in the south. This is also the part of the area with the lowest population and employment density (Figure 10).

An important note is that if the alternatives under consideration in the ongoing HOP study are implemented, this current segment would be reduced to 30-minute frequency, potentially increasing the utility of a Chautauqua route in the area. However, ridership on the segment of the HOP west of Broadway is currently quite low.

The past performance of Route 210 suggests that a regular, infrequeunt route to Chautauqua is unlikely to attract much ridership relative to its cost.

Figure 9: Southwest Boulder Transit services

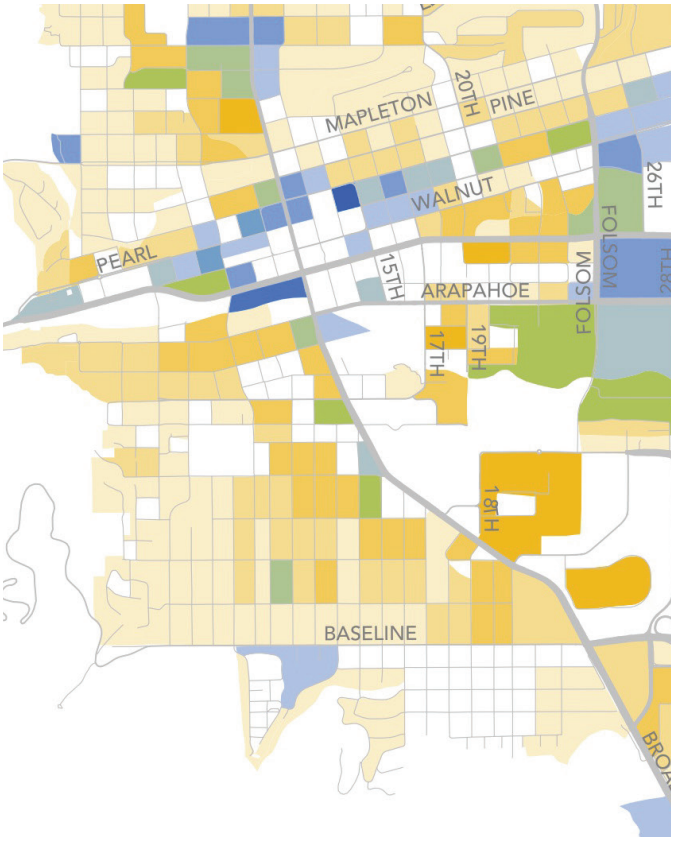


Figure 10: Southwest Boulder activity density

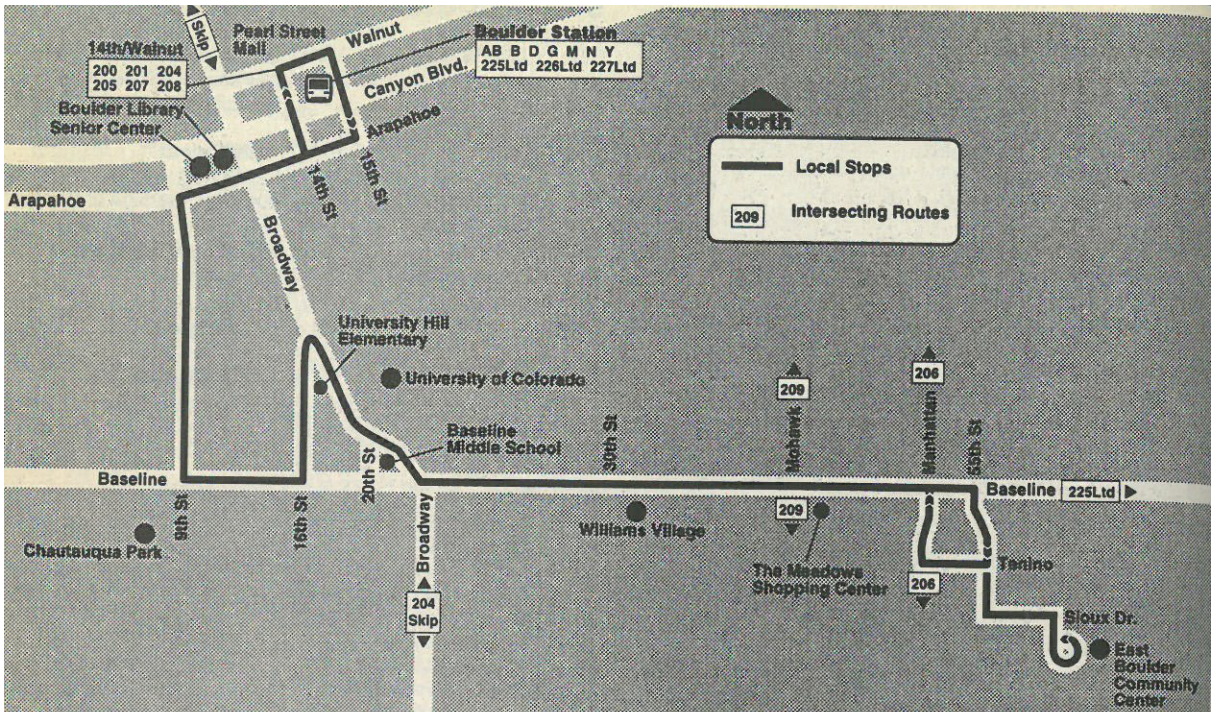


Figure 11: Discontinued RTD Route 203

RTD Route 203

Route 203 was a second now-discontinued service to Chautauqua. A map of this route is shown in Figure 11- it provided 30-minute service between downtown Boulder and East Boulder Community Center via 9th and Baseline, with a brief deviation in the middle to stop closer to the CU central area east of 20th and Broadway. The 203 was discontinued during a service change in 2012, with its segment serving East Boulder Community Center replaced by limited trips of the 225, which served Baseline extending east to Broomfield in the same way as it does presently. Since the 203 was discontinued, no RTD transit services reach Chautauqua.

Based on ridership data from August 2011 provided by RTD, it appears that Route 203 was able to attract more substantial ridership than the more limited 210. Per-trip averages from that month suggest that the 203 attracted around 700 boardings on an average weekday, equivalent to 10-11 boardings per one-way trip. From the trip records and run times from this month, we estimate that the 203's productivity was approximately 22 boardings per revenue hour, similar to the recent performance of routes like the 205 or 208[3].

The comparative success of the 203 connects to some of the observations we have previously made about how transit services succeed at attracting high rider-

3. Based on data received from RTD as part of the City of Boulder's HOP study for late 2014-early 2015 ridership and service hours on Boulder-area routes.

ship. Route 203's market included not only Chautauqua and the single-family area west of Broadway, but also high-density student housing near Baseline and 30th (Williams Village), apartments and a shopping center near Foothills Parkway and Baseline, and strong anchors (downtown and the community center) at either end, as shown by RTD's decision to continue to serve the community center with trips of the 225 after the 203's discontinuation. Generally speaking, the 203 served a variety of destinations and moderately dense areas with lots of potential customers, located far enough apart that transit represented a substantial time-savings compared to walking.

The lesson here for Chautauqua is that while a limited attempt to provide direct service (Route 210) did not attract substantial ridership in 2005, the later Route 203 performed substantially better due to its role as an integral portion of Boulder's transit network. While the design of such a route is outside of the scope of this study or the pilot project, looking back to the 203 does seem to suggest that Chautauqua service could be something worth considering if future transit network restructuring were to occur in Boulder.

Hop2Chautauqua

The City of Boulder already runs a transit service to Chautauqua, for special events and concerts in the Auditorium. This shuttle connects downtown and 27th Way & Broadway to the venue. It starts 2 hours before the show, and runs until 45 minutes after, with departures every 15 to 20 minutes.

If a concert sells out, 1,300 people converge on Chautauqua Auditorium during the short period of the event. The auditorium itself has no dedicated parking, so attendees who drive to the event must find parking either in the parking spaces in the lot and on-street near Chautauqua Green, around the CCA Cottages, along Baseline, or on streets to the north.

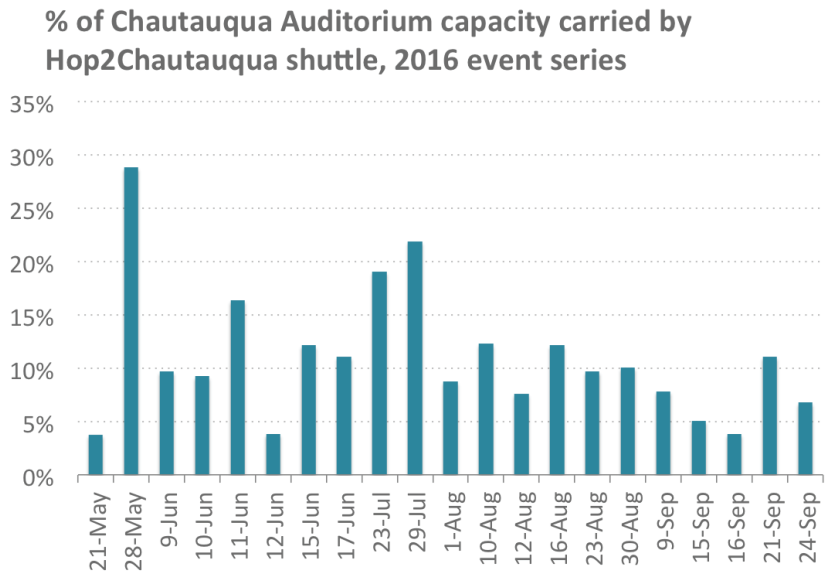


Figure 12: Hop2Chautauqua ridership expressed as a percentage of the hall's total capacity

Chautauqua Auditorium has a total capacity of 1,300 people. On average in 2016, about 11% of the hall's capacity was carried by the shuttle.[4] Some events, such as the concerts on July 23rd and 29th, and the graduation event on May 28th, produced transit ridership in excess of 20% of the hall's capacity. These ridership rates are very impressive, considering that they are happening in a context of free car parking, with no extra incentives to ride the shuttles.

4. Based on data provided by the City of Boulder for all shuttle services to events between May 21st and September 24th, 2016.

Potential strategies

Travel demand to the area around Chautauqua is highly seasonal and very focused on a particular destination. Given the City's focus on reducing carbon emissions, we expect that the City will continue to prioritize maximizing transit ridership, and is therefore unlikely to put resources into a new low-ridership route as opposed to other routes serving places with a higher likelihood of generating substantial ridership.

However, a more targeted transit service may be able to produce high ridership, relative to its cost, especially when it is paired with an access management program that provides a disincentive to driving to events.

The performance of the current Hop2Chautauqua is encouraging, suggesting that a targeted transit shuttle can help people access Chautauqua even if the cost of parking nearby increases and convenience decreases. Even greater ridership might be possible if there are further incentives to use the shuttle, such as free or discounted concessions at Chautauqua.

In terms of the immediate design of the pilot project transit service, the most feasible option is an all-summer shuttle providing access to the Open Space and Mountain Parks trail system surrounding Chautauqua. The ridership on the initial incarnation of this service will likely be highly dependent on the nature of the access management tools implemented, the convenience of the service itself, how well the service is integrated into the visitor experience, as well as the success of marketing efforts alerting potential users to its existence. In the next chapter, we provide a more detailed description and cost estimate for this shuttle service.

3 Preliminary Options

The main option under consideration for the upcoming pilot project consists of a seasonal shuttle route, connecting Chautauqua to downtown and off-site parking downtown or elsewhere. This route could run every day during the peak season, or on weekends during the highest-demand period. It would require a designated off-site parking facility with enough capacity to handle the expected number of diverted trips. Assuming the City of Boulder has sufficient transit vehicles, and a suitable parking area could be secured, such a service could be quickly implemented as part of the pilot project.

While not directly implicated in the pilot project, we also consider two other aspects of Chautauqua transit service, in order to provide a holistic view of options in the area:

- A year-round transit route serving Chautauqua either from the north via 9th, or from the east via Baseline. This could be considered as an expansion of a successful, more limited shuttle service. In the context of a wider transit network redesign, it could be possible to provide this service as an extension of another route. As a specific response to these parking issues, we discuss it here as a fully separable new component of the transit network.

- Improvements to the existing Hop2Chautauqua shuttle service. This shuttle service for summer concerts and events has already proved quite effective (carrying 10-20% of total concert attendees on many evenings). If further management of the parking supply near Chautauqua were established, this shuttle service would become even more important as a way for people to reach the Auditorium. Transit design for this option would mainly be focused on balancing shuttle capacity with expected diverted parking.

Each of these options could and should be used in concert with other access management tools such as time-limited parking or priced parking. These transit services' utilization will depend in large part on strategies for disincentivizing driving to the Chautauqua and parking nearby. While we focus on the seasonal shuttle, as it is more feasible as a part of the pilot project, we believe it is worthwhile to provide an assessment of the full range of transit options.

Buses	Hours per Day	Days per Year	Cost	Note
1	12	365	$350,400.00	1 bus, every day of the year
1	12	106	$101,760.00	1 bus, every Saturday and Sunday
1	12	45	$43,200.00	1 bus, every Saturday and Sunday May 1 - October 1

Figure 13: Basic Costs of Boulder Transit Service Units

The remainder of this section describes each of these options in detail, including possible cost impacts and key design decisions.

Note on Costing

In order to describe the possible costs of these different service options, we have developed estimates based on the current costs and operating data for the City of Boulder's HOP route. One hour of transit service (a bus and a driver, on the road, accepting passengers, for one hour) currently costs the City about $80 (as purchased on its current contract with VIA). The longer a transit route, the higher its frequency, and longer its duration of service, the more expensive the service will be. The table in Figure 13 provides a simple summary of the cost of some different units of service.

The major cost driver of transit is the number of drivers and vehicles required to operate a service. It is worth noting that in the past 2 years, Colorado transit agencies have faced long lead times for purchasing new vehicles. Boulder's HOP service is behind on its vehicle replacement schedule, and also struggles to keep a full crew of drivers. As a result, any option that requires transit vehicles and drivers beyond the service operator's current fleet and crew may be difficult to implement soon.

Routing and Parking Options

There are only a few basic options for routing transit services to Chautauqua. A prospective service to Chautauqua must connect to either off-site parking or other transit services (or both) to be a viable alternative for people visiting from other parts of the city or region. The service must touch the places where these connections are possible.

At the same time, people have low tolerance for riding a long way out of their intended direction, so the route

should not squiggle around a great deal before delivering passengers to their destinations. In terms of the streets a route could use, Baseline and 9th are the only suitable paths to reach Chautauqua, since both are 2-lane roads carrying a higher traffic volume than surrounding residential streets.

Finally, from FTH's study, we know that the majority of summer Chautauqua visitors (64%-88%) arrive from the east via Baseline, many driving past substantial parking capacity at CU and RTD's park and ride lots, as shown in Figure 14.

Where would people traveling to the Chautauqua catch the shuttle?

- Downtown Boulder offers the most transit service to the most destinations, and has many hotels and amenities that visitors may also want to access. It also has several paid parking lots that people traveling to Chautauqua via transit could use.
- CU owns a number of parking lots near Broadway & Regent. Especially during the peak summer season, when traffic to the university is lower, these parking lots present a compelling opportunity for an off-site parking location for a shuttle to Chautauqua. This presents the shortest, and thus cheapest, opportunity for a parking shuttle service.

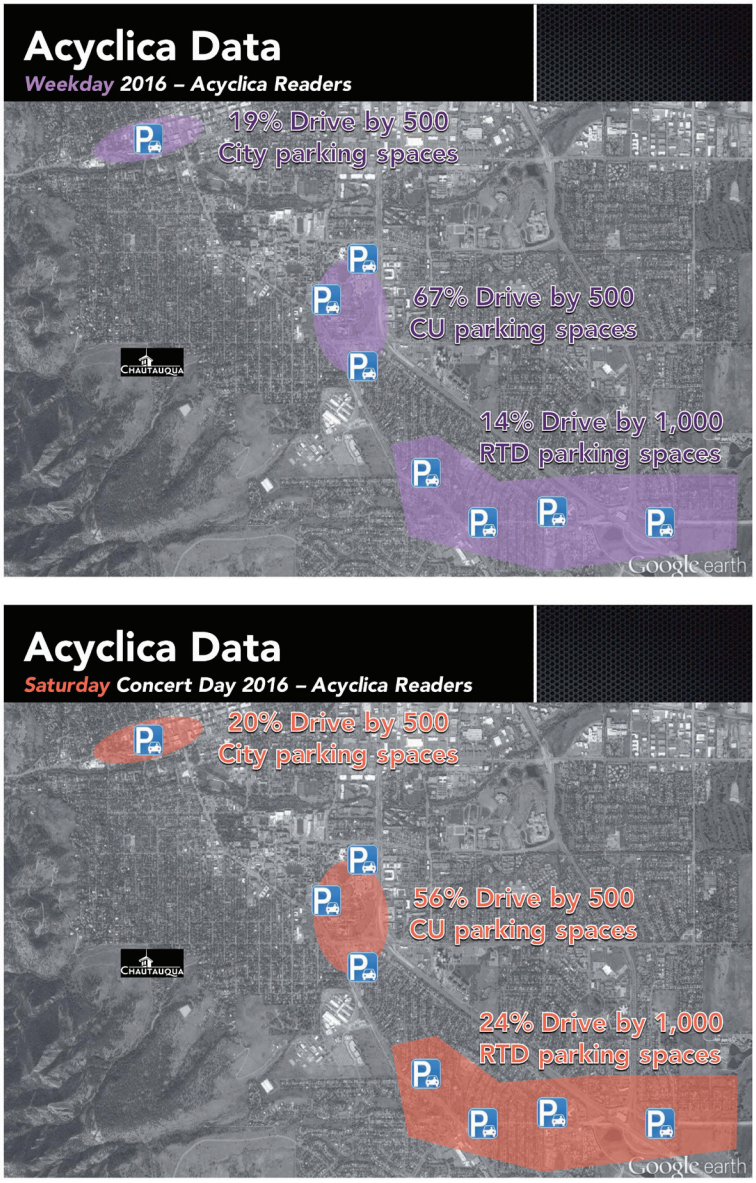


Figure 14: Chautauqua visitors' arriving trips and nearby parking opportunties (Fox-Tuttle Hernandez)

RTD also owns substantial parking capacity further south, such as the Table Mesa Park and Ride near the US-36 / Foothills Parkway interchange. However, the use of these facilities would require both a substantially longer and more expensive transit routing, as well as cooperation with RTD. As a result, we have focused on the Downtown and Broadway & Regent locations as the primary endpoint options for the shuttle.

As a result, there are three main transit segments that could be operated to provide Chautauqua service:

- **A - Downtown to Chautauqua.** Via Canyon and 9th; 3.7 miles round-trip.
- **B - CU parking lots east of Broadway to Chautauqua.** via Kittredge Loop, Regent, 20th, Baseline; 3.6 miles. If the turnaround via Kittredge Loop is not possible, this segment could turn around via Broadway and Baseline, a slightly shorter path (2.8 miles).
- **C- Running a shuttle similar to Segment B, but continuing via US-36 to Table Mesa Park and Ride.** This would have a total distance of 6 mi. If such a segment included both the Broadway & Regent lots AND Table Mesa, the looping needed to serve the CU lots adds substantial distance, for a total length of 8.9 mi.

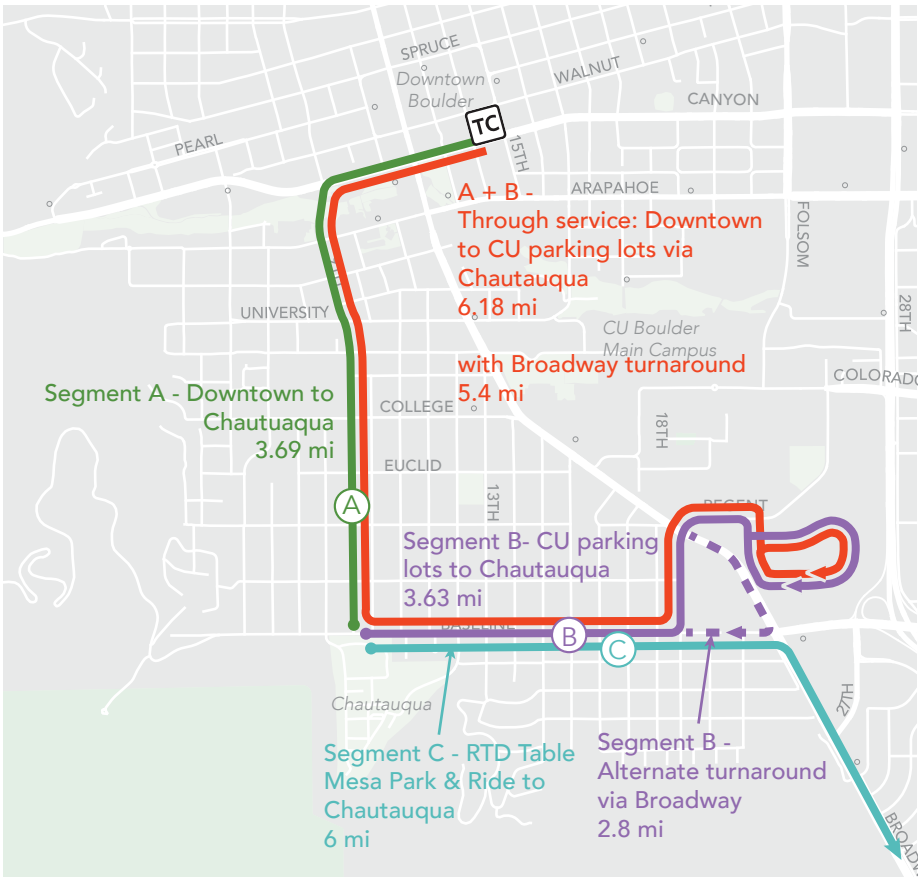


Figure 15: Chautauqua Routing Options

Segments A and B could be linked together, eliminating the need to turnaround in or near Chautauqua. This option would have a total distance to 5.4 miles. Linking A and C is considerably longer, 9.7 mi. A+C, including the Broadway & Regent lots, has a total length of 12.6 mi.

If a route were operated on only segment A, B or C, a turnaround near Chautauqua would be required. The preferred solution would be to turn around transit vehicles using the roadways surrounding Chautauqua Green, since these roads are closest to the final destination of shuttle passengers, but this presents several problems.

First of all, this is a highly congested area during peak demand periods, when many people circle the Green seeking a parking space. This is also an a pedestrian-intensive area with limited sidewalk or crossing infrastructure, raising potential bus-pedestrian interaction challenges. Finally, the roadways and necessary turns needed

to use this segment are quite tight, although private tour buses and school buses currently operate here.

Seasonal Shuttle

Parking issues near Chautauqua are most acute during the summer months, when activity at the nearby open space is greatest and when the bulk of the Chautauqua's musical and artistic programming occurs. A seasonal management approach incorporating both parking and a transit alternative is the most feasible pilot project option.

For the purposes of cost estimation, we have assumed a seasonal operating period including the months of May through October (May 1 to October 1). This period has 153 total days, and 43 weekend days. All other operational parameters of the options are held constant.

Note on Capacity

An important question for the final design of a shuttle service is the required capacity throughout the day. While the options we've presented here are simple illustrations of different service designs, the exact number of trips per hour that should be offered will depend on the rate of arrivals and departures of visitors to the Chautauqua. The transit solution would be designed to reflect the level of peaking in the arrival and departure traffic suitable to serve the actual in-and-outflow of visitor traffic. However, the utility of the service (how convenient it is for people to adopt it is an alternate means of travel) will also impact the actual ridership uptake.

General Overview

The lowest-cost options for seasonal Chautauqua transit service are weekend routes using either segment A or B, operating every 30 minutes. These would cost approximately $41,000 in the first year assuming an operating cost of $80 per service hour. However, staff and the community may feel that it is desirable to connect the two segments together, to include service to one of RTD's park and rides, or to operate service more frequent or on more days of the week. We have provided estimates for a range of these options in the table in Figure 16 on the next page.

Segment	Round Trip Miles	Mph	Run Time (min)	Frequency (min)	Cycle (min)	Buses	Span of Service	Revenue Hours per Day	Days per Year	Annual Cost @ $80/hr	Annual Cost per Additional Hour of span
Every Day Service Options											
A	3.69	10	24	30	30	1	12	12	153	**$146,880**	$12,240
B	3.63	10	22	30	30	1	12	12	153	**$146,880**	$12,240
A+B	6.18	10	37.1	30	60	2	12	24	153	**$293,760**	$24,480
C	5.9	10	35.4	30	60	2	12	24	153	**$293,760**	$24,480
A+C	9.7	10	58.2	30	90	3	12	36	153	**$440,640**	$36,720
Every Day Service Options - High Frequency											
A	3.69	10	24	15	30	2	12	24	153	**$293,760**	$24,480
B	3.63	10	22	15	30	2	12	24	153	**$293,760**	$24,480
A+B	6.18	10	37.1	15	60	3	12	36	153	**$440,640**	$36,720
C	5.9	10	35.4	15	60	3	12	36	153	**$440,640**	$36,720
A+C	9.7	10	58.2	15	90	5	12	60	153	**$734,400**	$61,200
Weekend Service Options (Saturdays and Sundays only)											
A	3.69	10	24	30	30	1	12	12	43	**$41,280**	$3,440
B	3.63	10	22	30	30	1	12	12	43	**$41,280**	$3,440
A+B	6.18	10	37.1	30	60	2	12	24	43	**$82,560**	$6,880
C	5.9	10	35.4	30	60	2	12	24	43	**$82,560**	$6,880
A+C	9.7	10	58.2	30	90	3	12	36	43	**$123,840**	$10,320
Weekend Service Options - High Frequency											
A	3.69	10	24	15	30	2	12	24	43	**$82,560**	$6,880
B	3.63	10	22	15	30	2	12	24	43	**$82,560**	$6,880
A+B	6.18	10	37.1	15	60	3	12	36	43	**$123,840**	$10,320
C	5.9	10	35.4	15	60	3	12	36	43	**$123,840**	$10,320
A+C	9.7	10	58.2	15	90	5	12	60	43	**$206,400**	$17,200

This table does not include every possible shuttle option. For instance, one of RTD's parking facilities other than Table Mesa could be selected; or, another site entirely could be chosen as the off-site parking location. Instead, we've selected options that illustrate expected costs at a range of service levels.

As noted earlier, options requiring more vehicles may prove unfeasible to implement quickly due to the constraints of the City's available fleet.

Figure 16: Seasonal Chautauqua Transit Options

Options' costs vary by length and frequency, which directly control the required number of vehicles and thus drivers. We have also included the cost per hour to add hours of service each day.

Incorporating the HOP

It could be possible to integrate a seasonal transit service with the HOP if one of the alternatives currently being contemplated for that service is implemented. In each alternative, the current HOP loop is transformed into several separate routes, one of which, Route C, serves Southwest Boulder (shown in Figure 18).

While universities are year-round major destinations, travel to them is lower in summer, when many students do not attend classes. The HOP alternatives send Route C to the university because most of the year, for the area along 9th north of College, the University is likely to be a more compelling destination than Chautauqua, and therefore likely to attract more riders.

During the summer, this situation may be different. Chautauqua is a much higher-trafficked area when the outdoor recreation opportunities nearby are more attractive, and most of the Auditorium's major events happen during this time. For this reason, sending Route C to Chautauqua during the summer could be a more valuable use of the service than continuing to run it to CU.

Since Route C has essentially the same operational parameters as the 30-minute options using Segment A, it could be rerouted to Chautauqua without any additional resources.

The lowest-impact option is to simply reroute C to Chautauqua during summer weekends. This would preserve to weekday connection to CU from the area around 9th and University for people who are still working or studying there in the summer, while offering a transit alternative for Chautauqua during busy summer weekends.

Alternatively, during summer the route could go to Chautauqua every day.

In either case, additional resources would be required either to operate this seasonal service at higher frequency, or to serve both Segment A and Segment B. However, by using the HOP's existing resources (assuming it is restructured), a smaller level of new funding would be required than in other options.

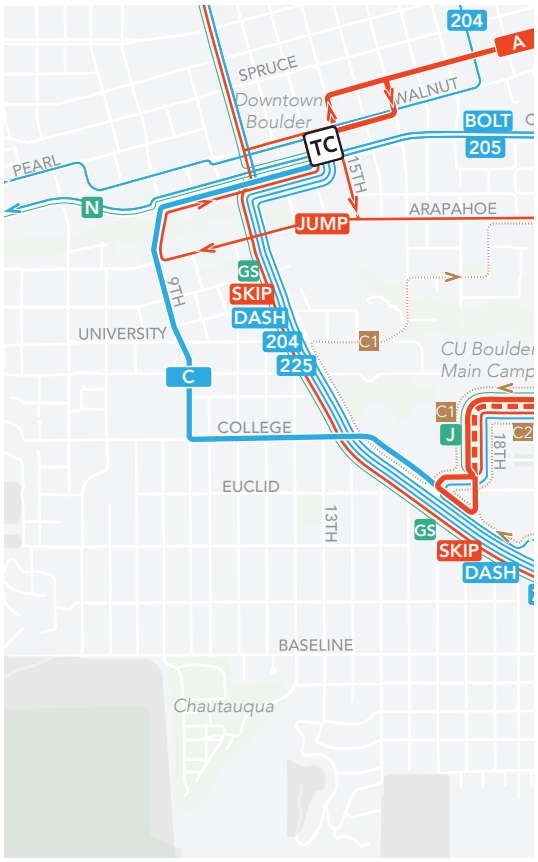


Figure 17: HOP Alternative 1, Southwest Boulder detail

In all 4 of the HOP study alternatives that reconfigure the HOP loop into multiple routes, a Route C is present operating at 30 minute headways in Southwest Boulder.

On this map, red lines run every 15 minutes, blue lines run every 30 minutes, green lines less often, and brown lines are CU's campus transit network.

Year-Round Route

When most people think of a "transit route," the first thing they typically imagine is a service that is available at predictable times and places, everyday, or at least every weekday. Most of the transit services operating in Boulder fit this description, in that they operate throughout the year on each or a few selected days of the week. How could this most conventional transit tool be applied to Chautauqua?

The simplest option is to provide something that looks very similar to the old Route 210 - a direct, everyday service to Chautauqua from downtown Boulder, possibly continuing on to reach Broadway and CU to the east. Of course, understanding the nature of demand for travel to Chautauqua in 2016, with its heavy focus on weekend leisure trips, we would want to offer weekend service on their route as well (which the old Route 210 did not).

Figure 19 presents cost estimates and operational details for year-round services on both segments, and in combination, for every-day service and weekend-only options. Here we have provided costs for these segments at 30-minute and 15-minute headways, for an operational period of 12 hours per day. Additional hours (for instance, evening services) have simple unit costs.

Running a service at any frequency via either segment A or B has an equivalent cost, since these segments are approximately of equivalent length.

Incorporating the HOP

The City of Boulder's ongoing HOP study has presented several service alternatives involving route segments in the southwest Boulder area. None of these has so far included service to Chautauqua, but all include a 30-minute-frequency route in southwest Boulder that requires only one bus and driver to operate. For that same bus and driver (and therefore same operating cost) this "Route C" could go to the Chautauqua instead of to CU, if desired. Detail from the map of HOP Alternative 1 is shown in Figure 18.

As described in the HOP study, this Route C would have the following characteristics:

- 365 days of service

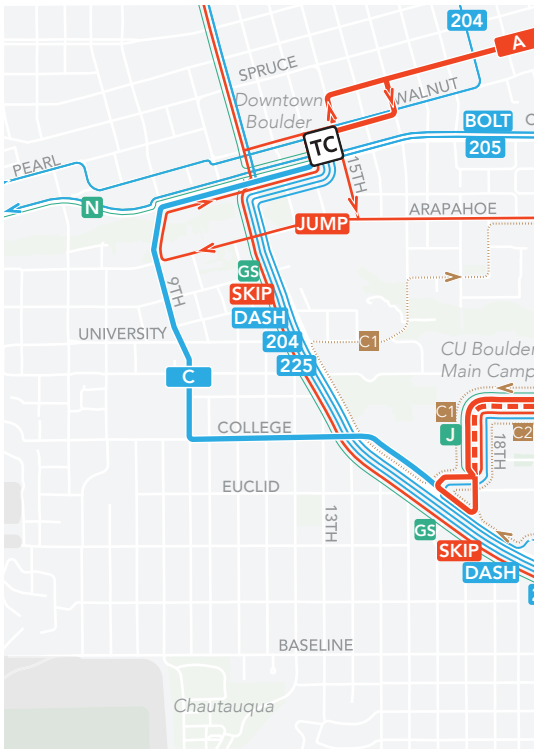


Figure 18: HOP Alternative 1, Southwest Boulder detail

In all 4 of the HOP study alternatives that reconfigure the HOP loop into multiple routes, a Route C is proposed, with 30 minute frequency in southwest Boulder.

Segment	Round Trip Miles	Mph	Run Time (min)	Frequency (min)	Cycle (min)	Buses	Span of Service	Revenue Hours per Day	Days per Year	Annual Cost @ $80/hr	Annual Cost per Additional Hour of span
Every Day Service Options											
A	3.69	10	24	30	30	1	12	12	365	**$350,400**	$29,200
B	3.63	10	22	30	30	1	12	12	365	**$350,400**	$29,200
A+B	6.18	10	37.1	30	60	2	12	24	365	**$700,800**	$58,400
Every Day Service Options - High Frequency											
A	3.69	10	24	15	30	2	12	24	365	**$700,800**	$58,400
B	3.63	10	22	15	30	2	12	24	365	**$700,800**	$58,400
A+B	6.18	10	37.1	15	60	3	12	36	365	**$1,051,200**	$87,600
Weekend Service Options (Saturdays and Sundays only)											
A	3.69	10	24	30	30	1	12	12	104	**$99,840**	$8320
B	3.63	10	22	30	30	1	12	12	104	**$99,840**	$8320
A+B	6.18	10	37.1	30	60	2	12	24	104	**$199,680**	$16,640
Weekend Service Options - High Frequency											
A	3.69	10	24	15	30	2	12	24	104	**$199,680**	$16,640
B	3.63	10	22	15	30	2	12	24	104	**$199,680**	$16,640
A+B	6.18	10	37.1	15	60	3	12	36	104	**$299,520**	$24,960

Figure 19: Year-Round Chautauqua Transit Options

- 30-minute frequency for 12 hours per day; 60-minute frequency for 3.5 additional hours in the evening
- 30-minute cycle time (scheduled round trip time)
- 5,658 annual revenue hours, for an annual cost of $452,600.

One question raised in the HOP planning process was whether Route C should terminate at CU and the transit hub at 18th and Euclid, or whether it should terminate at the Chautauqua. Ultimately, service to CU was included in the alternatives because it was judged by City staff and the consultant team to be the highest ridership option. However, service to Chautauqua may be desirable for other reasons.

Essentially, the HOP study includes a route with sufficient resources to provide direct 30-minute service to Chautauqua from Downtown. These resources could also be combined with new funding to create a more frequent route, or to extend the Chautauqua service along both

Segment A and Segment B, connecting downtown, Chautauqua, and the CU parking lots near Regent.

Hop2Chautauqua Improvements

The last set of options for Chautauqua service involve improvements to the City's existing Hop2Chautauqua event service. Chautauqua concerts are times of high parking demand in the area, as many people converge at one time to attend an event at the 1,300-person capacity Chautauqua Auditorium.

As we noted earlier in this report, the current service already carries 10% or more of the hall's capacity on many event dates. On nights where the show is not sold out, the proportion may be even greater. So the question for this service is what, if anything, can be done to increase its share of event-related trips?

To begin with, if parking management strategies are implemented near Chautauqua; are in effect during evening hours when these events happen; and are successful at discouraging some auto traffic, it is likely that the Hop2Chautauqua would absorb at least some of the diverted traffic, without any changes to the service.

Because the current Hop2Chautauqua service is quite frequent, and serves very logical destinations, improvements would mostly be around accommodating the additional demand that parking management would create. In other words, if the management strategies divert *x* proportion of the current non-transit event trips, is the shuttle marketed effectively and offering sufficient capacity to absorb *x* trips?

The Chautauqua Auditorium holds 1,300 people. That is the total quantity of passengers that could feasibly ride the shuttle. In 2016, an average of 136 passengers or 11% of event capacity rode the shuttle, which operated every 15 or 20 minutes (3 or 4 trips per hour) for two hours before and 45 minutes after the event.

On a 40-ft bus, standard configurations offer approximately 40 seats, with room for another 35 people to stand. 75 people is a commonly used total seated + standing capacity, though of course buses in high-de-

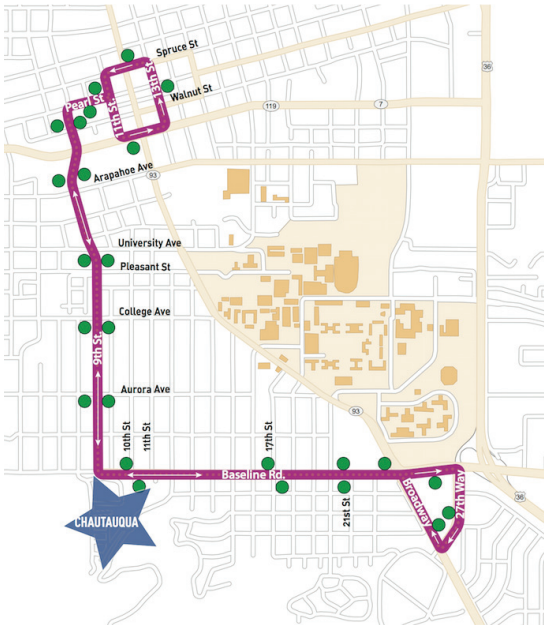


Figure 20: Hop2Chautauqua Route

mand areas routinely carry more people. The HOP buses are somewhat smaller (30-ft), with a total seated + standing capacity closer to 50.

At 3 trips per hour, that works out to a total capacity of 450 or 280 passengers taken to the venue during the two hour service period, depending on the vehicle. With an average of 136 passenger trips per event, approximately 50% of the available transit capacity was used in 2016.

Access management should divert some of the car traffic during events to other modes; Hop2Chautauqua as currently operated has the capacity to absorb some of it, depending upon how intensively parking is managed. However, this shift will not happen without marketing and other actions to attract new customers. This involves not only raising customer awareness about the service, but may also include incentives to balance ridership across the shuttle's span of service.

If access management and marketing send an additional 100 trips to the Hop2Chautauqua, but those people all decide to travel on the last shuttle trip to the show, a new capacity issue will have been created. While it is certainly possible to add another bus to the shuttle route, offering incentives like refreshment discounts to passengers who catch earlier buses could help smooth demand across the service period, and may be cheaper than the combined labor and maintenance cost of deploying another vehicle and driver at peak times.

40 ft bus capacity	40 (75)
HOP bus capacity	25 (50)
Trips per hour	3
Passenger capacity per hour - 40 ft	120 (225)
Passenger capacity per hour - HOP	75 (140)
Hours of service prior to event	2
Total pre-event transit passenger capacity (40 ft)	240 (450)
Total pre-event transit passenger capacity (HOP)	150 (281)

Figure 22: Hop2Chautauqua passenger capacities (standing + seated shown in parenthesis)

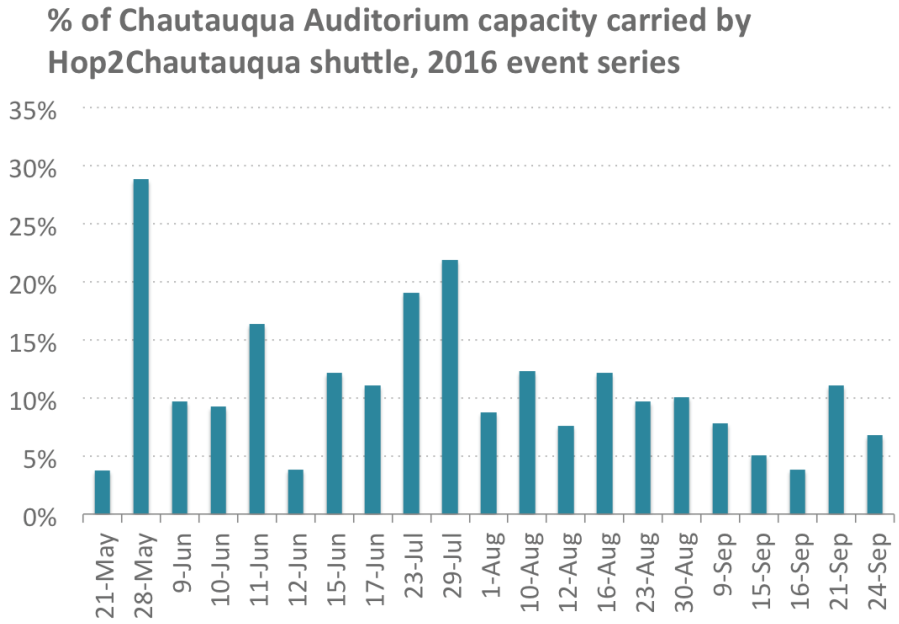


Figure 21: Hop2Chautauqua ridership expressed as a percentage of the hall's total capacity

Ridesharing

In recent years, ridesharing services provided by transportation network companies (TNCs) have become a common topic of discussion during transit planning processes. The prospect of offering a small subsidy to a private operator, avoiding the need to plan an operate a public service, can sometimes be seen as an attractive and simple method of addressing a transportation issue. Many cities and transit agencies are now exploring TNC partnerships, but this mobility tool, like transit, driving, and any other mode, is subject to certain constraints, and works best under certain conditions.

Existing Downtown Boulder Pilot

Currently, the downtown Boulder business community is engaged in a pilot project called D2D, which offers a ride subsidy to people using ridesharing to make trips to shop or eat downtown, as well as their return trip home. The ride subsidy structure is emerging as a common method for integrating ridesharing and transit. For example, a transit provider might offer a ridesharing subsidy for trips beginning or ending at a light rail station as a way to solve the last-mile problem.

Could a similar option be a possible future method of maintaining or enhancing access to Chautauqua?

Potential for Chautauqua

A service of this type, if coupled with a parking management strategy or ride subsidy, could be expected to shift some traffic from personal automobile to TNC. The extent to which this is possible depends largely upon the nature of the subsidy and management. However, it is important remember several important facts about ridesharing services:

- As conventionally operated, most ridesharing vehicles are low-capacity cars or vans. This means that unless an agreement to use higher capacity vehicles or trip pooling could be arranged, the total VMT and car traffic to Chautauqua would not be reduced by shifting trips to ridesharing, although those trips would not require a parking space.

- Depending upon the reliability of visitors arrival and departures, the number of rideshare vehicles and VMT to Chautauqua could actually represent an increase from current levels, because each ride-share driver may not have a passenger to pick up for a return trip on each arrival at Chatuauqua. This is subject to the dynamics of travel demand to the area throughout the day.
- Ridesharing is most useful for distributing trips among a set of destinations that are not easily served by a direct, higher-capacity service. As a result, ridesharing is poorly suited to serving many trips between two discrete points (as would be the case with an off-site parking shuttle), since these trips could be more cheaply served with a higher-capacity vehicle.

Because of its lower per-vehicle capacity, ridesharing is probably best suited to a complementary role with a parking shuttle, focused on serving local trips that do not originate at the shuttle parking lots or downtown. The D2D pilot is an interesting example of a framework under which a similar service could be delivered.

Picking the Right Tool

Which mix of options is the best choice for the pilot project, and for long-term implementation? In the short term, for a limited-duration, summer 2017 pilot, the seasonal option is likely an appropriate tool.

The quantity of service to offer on a 2017 seasonal shuttle will depend a great deal on available financial resources for this pilot project.

We assume that the 2017 pilot projects will also include parking management. Given that this will increase demand for the existing Hop2Chautauqua shuttle, it will be necessary to plan ahead for careful management of the Hop2Chautauqua's capacity at large events.

4 Appendix and Additional Technical Materials

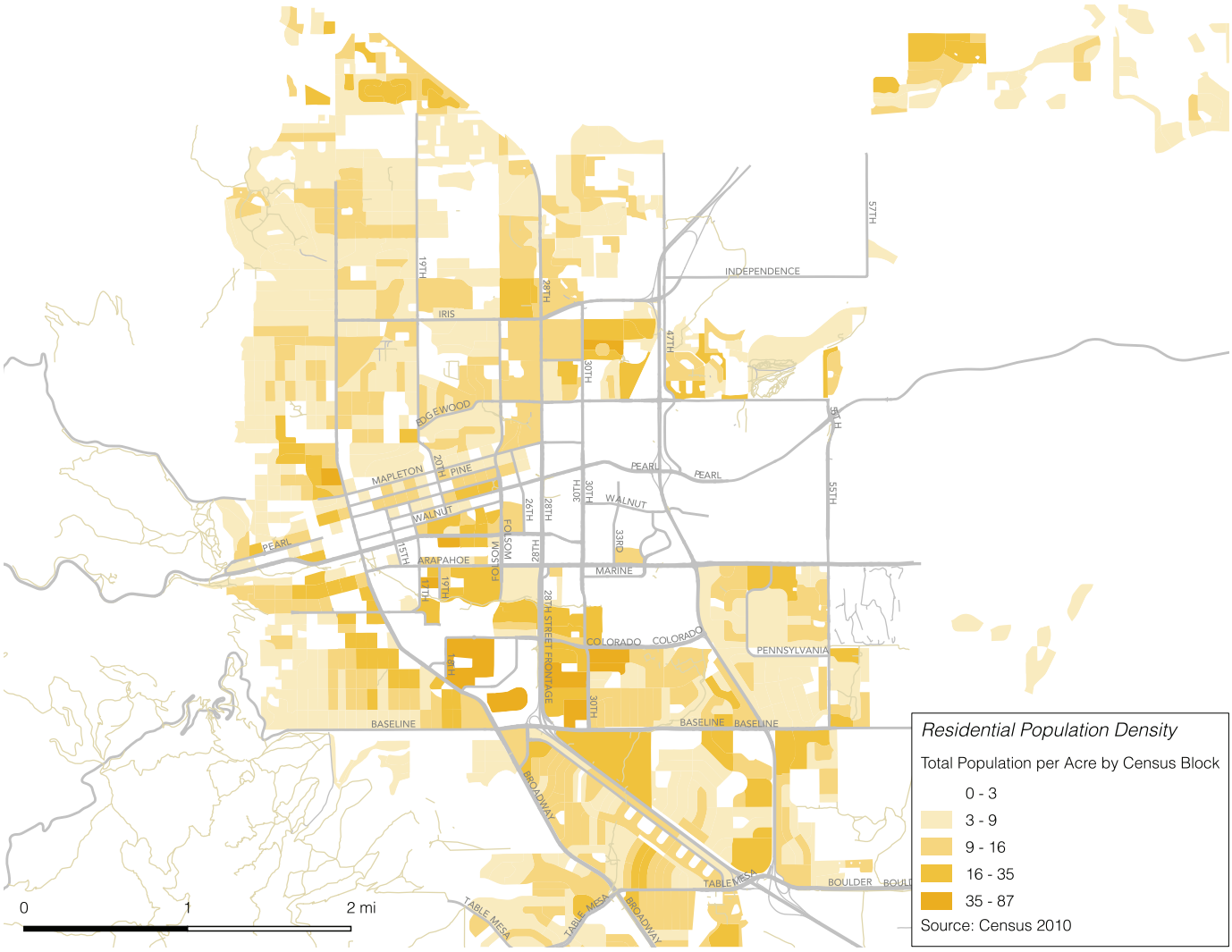


Figure 23: Boulder Residential Density Map (2010 Census Estimates)

Residential density

The first way we can tell whether there is likely to be a strong market for transit is to see how many people live near a proposed service. Figure 23 shows residential density across the entire city, from the smallest geographical area, census blocks, from the 2010 census.

We use this older data set because it offers data at a finer level of geographical detail than more recent American Community Survey estimates, and because the area near Chautauqua has grown slowly since the 2010 census year. According to census bureau estimates, while the City of Boulder has grown 7-10% between 2010 and 2015, the census tracts near Chautauqua (122.01, 124.01, and 125.05 in Figure 24) have grown only 3-5% during that span. This represents increase of around 475-800 people across the entire area, a number too small to dramatically effect the character of the broader

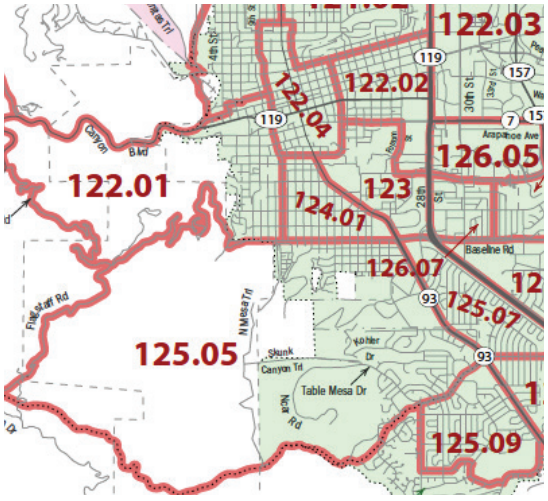


Figure 24: Chautauqua Area Census Tracts (US Census Bureau map)

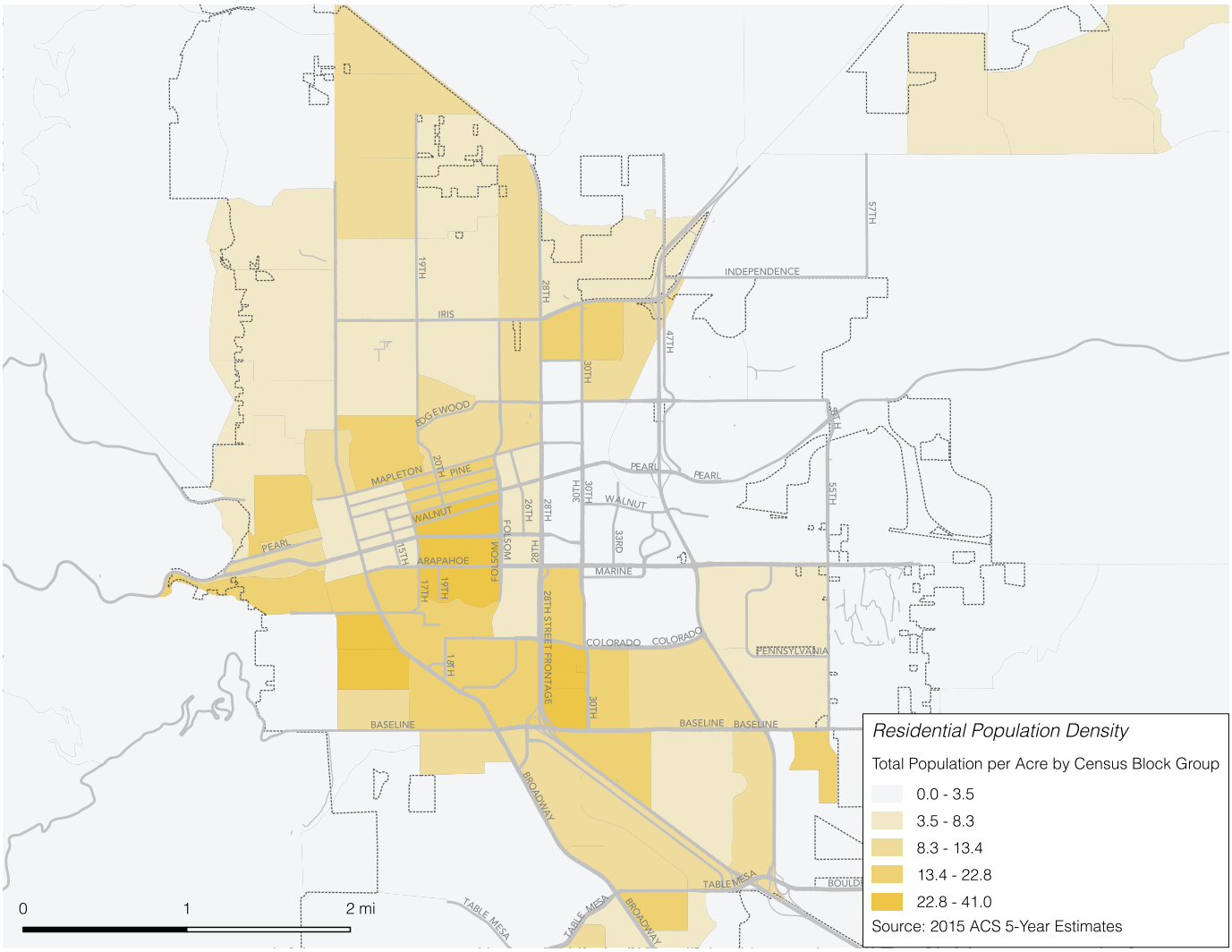
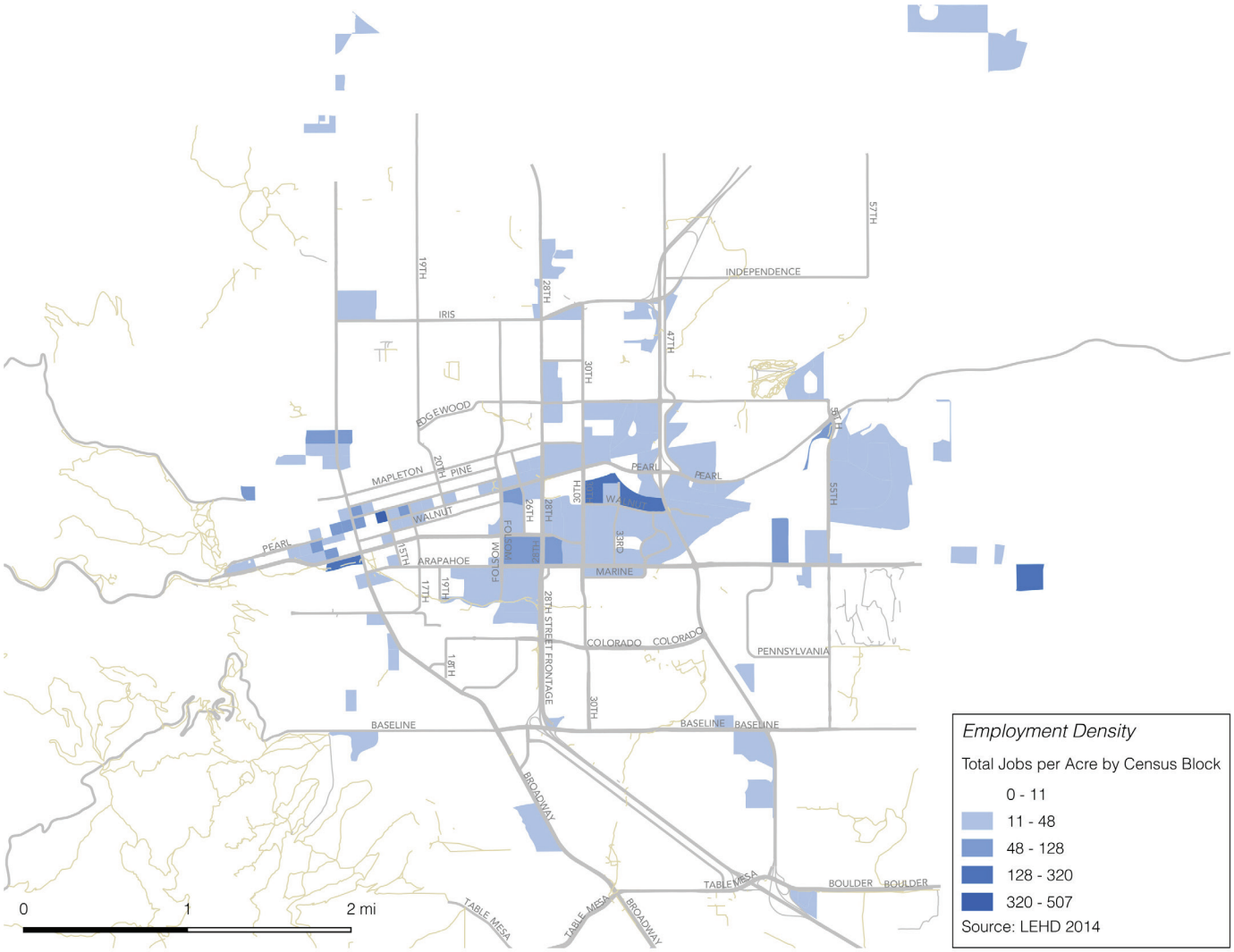


Figure 25: Boulder Residential Density Map (2015 ACS 5-Year Estimates)

transit market. When we examine the most recent, less detailed population estimates, the pattern is similar (see Figure 25).

In the neighborhoods near Chautauqua, density is higher towards the east, near Broadway. This means that a large percentage of residents are walking distance from very frequent transit on Broadway. While the blocks along Broadway are of moderate density compared to other parts of the city, they are already well-served by very frequent and long-span transit on Broadway. This means that the larger number of people living in those blocks have little incentive to walk west to get their transit service.

Most blocks in the areas that are not walking distance from transit on Broadway, have lower residential densities, i.e. a smaller number of residents per acre.



Job density

The strongest transit markets have a mix of residential and commercial activities along them. This generates transit demand at many different times, in different directions, along the entire length of the route.

Job density shows where there may be transit demand for commuting, but it also shows the places where people may want or need to go for shopping, entertainment and services.

About 140 people work in the Census block containing the Chautauqua. Job density in the larger CAMP study area is low, because of the mostly single-family residential nature of the area. Aside from events at Chautauqua, there is little daily commercial activity that would draw potential transit riders to the area, though outdoor recreation does draw regular visitors, especially in summer.

Figure 26: Boulder Job Density Map.

Note that employment data for CU represents a tiny fraction of the demand for daily travel to campus, by students. If students were counted in this data set, CU blocks would be darkly shaded.